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EXAMINER

TRAN, NHAN T

ART UNIT

PAPER NUMBER

2615

DATE MAILED: 08/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/410,800

Applicant(s)

ACHARYA ET AL.

Examiner

Nhan T. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 October 1999.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4-8.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Objections

1. Claims 7, 11 & 12 are objected to because of the following informalities: line 3 of each claim 7, 11 & 12 recites the limitation "the two mutually orthogonal direction" which should be changed to – the two mutually orthogonal directions – .

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1 – 6, 11, 12 & 16 – 20 are rejected under 35 U.S.C. 102(b) as being anticipated by Maenaka et al (US 5,552,827).

Regarding claim 1, Maenaka discloses a method of interpolating color pixel from a subsampled color image comprising:

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for a particular pixel location (i.e., center pixel) in the subsampled image, comparing relative changes (vertical and horizontal correlation) in particular color pixel signal level for two mutually orthogonal directions (vertical and horizontal directions) across the particular pixel location using pixel signal values immediately adjacent to the particular pixel location; and

computing a color signal value (i.e., Ro, Bo, Go) for that particular pixel location for a color plane other than the color plane of the pixel signal value in the subsampled color image at that location by relatively weighing the pixel signal values, the relative weights, at least in part, on the relative change of pixel signal level in a particular direction (see Figs. 2, 8(A)-(B), 14 & 15; col. 2, lines 37-43; col. 4, lines 46-51; col. 5, lines 33-41; col. 8, line 25 – col. 9, line 32; col. 13, lines 60-65 & col. 14, line 54 – col. 15, line 58 wherein, for example, R color presents a color plane of Red, G color presents color plane of Green, etc...and missing Red color is calculated based on both adjacent Green and Red colors as shown in equations (3), (9) & (12) or equations (36) & (39)).

Regarding claim 2, computing signal a color signal includes relatively weighing the pixel signal values by relatively weighing more heavily the pixel signal values associated with the direction increasing less relatively in pixel signal value level for the particular pixel location (see col. 9, lines 1-19).

Regarding claim 3, the subsampled image comprises an image in RGB space format (see Figs. 8 & 13).

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Regarding claim 4, the subsampled color image comprises a Bayer pattern (see Figs. 8 & 13).

Regarding claim 5, the color plane of the pixel signal value at the particular pixel location comprises R color plane (see equations (3), (9) & (12) in col. 6 & 7 or equations (36) & (39) in col. 15 wherein missing Red color is computed based on color values of Green and Red in the Green and Red color planes, respectively);

the two mutually orthogonal directions comprising the horizontal and vertical directions; the particular color plane for the color signal value being computed comprises the G plane (i.e., plane of G22 in Fig. 8(A) or G23 in Fig. 13(A)); and the particular color for the pixel signal value levels being compared comprises G (see equations (3), (9) & (12) or equations (36) & (39) & col. 13, line 60-65 wherein all color planes are utilized for detecting correlation).

Regarding claim 6, the color plane of the pixel signal value at the particular pixel location comprises B color plane (see equation 6 in col. 7 or equations (44), (45) & (47) wherein missing Blue color is computed based on color values of Green color plane and Blue color plane);

the two mutually orthogonal directions comprising the horizontal and vertical directions (for computing horizontal and vertical values, i.e., Bh & Bv);

the particular color plane for the color signal value being computed comprises the G plane (i.e., plane of G22); and the particular color for the pixel signal value levels being compared comprises G (see equation 6 or equations (44)-(47); col. 13, lines 60-65 wherein all color planes are utilized for detecting correlation).

Regarding claim 11, the color plane of the pixel signal value at the particular pixel location comprises the G color plane; the two mutually orthogonal directions comprising the horizontal and the vertical directions; the particular color plane for the color signal value being computed comprises the B plane; and the particular color for the pixel signal value level being compared comprises B hue (G-B) as shown in col. 14, lines 14-18 & line 54 – col. 15, line 58).

Regarding claim 12, see claim 11 for similar analysis in which R color is involved for calculating green color in equation (43) in col. 15.

Regarding claim 16, the claimed limitations are analyzed with respect to claim 1.

Regarding claim 17, the claimed limitations are analyzed with respect to claim 3.

Regarding claim 18, the claimed limitations are analyzed with respect to claim 4.

Regarding claim 19, the claimed limitations are analyzed with respect to claim 1, wherein a computing platform is presented by the hardware circuitry shown in Figs. 2, 10 & 14.

Regarding claim 20, the claimed limitations are analyzed with respect to claim 3.

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3. Claims 1, 13, 16 & 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Hamilton, Jr. et al (US 5,629,734).

Regarding claim 1, Hamilton discloses a method of interpolating color pixel signals from a subsampled color image comprising:

for a particular pixel location in the subsampled image, comparing relative changes in a particular color pixel signal level for two mutually orthogonal directions (horizontal and vertical) across the particular pixel location using pixel signals values immediately adjacent to the particular pixel location; and computing a color signal value for that particular pixel location for a color plane other than the color plane of the pixel signal value in the subsampled color image at that location by relatively weighting the pixel signal values, the relative weights depending, at least in part, on the relative change of pixel signal value in a particular direction (see Figs. 2-6; col. 4, lines 34-53 & col. 5, line 25 – col. 6, line 29 wherein the relative weights are represented by pixel classifier values in which interpolation method is selected based on the pixel classifier).

Regarding claim 13, the claimed limitations are analyzed with respect to claim 1. Additionally, a storage medium, having stored thereon instructions to be executed by a system for interpolation of color pixel values from a subsampled image is inherent in Hamilton (see Figs. 3 & 5 for the software instructions).

Regarding claim 16, the claimed limitations are analyzed with respect to claim 1.

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Regarding claim 19, the claimed limitations are analyzed with respect to claim 1, wherein a computing platform is presented by the circuitry shown in Fig. 1.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 7 – 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maenaka et al (US 5,552,827) in view of Hamilton, Jr. et al (US 5,629,734).

Regarding claim 7, Maenaka discloses the color plane of the pixel signal value at the particular location comprises the R color plane (see Figs. 8 & 13 wherein the particular, i.e., center pixel, must comprise three primary colors R, G and B which belong to Red, Green and Blue color planes, respectively);

the particular color plane for the color signal value being computed comprises the B plane (presented by B color) and the particular color for the pixel signal value level being compared comprises B hue (G-B) as shown in col. 14, lines 14-18.

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Maenaka does not teach that the two mutually orthogonal directions comprising the main diagonal and the secondary diagonal directions. However, as taught by Hamilton, two diagonal directions are utilized in a chroma (red/blue) interpolation process so that artifacts in output image are substantially reduced as shown in Fig. 5; col. 4, line 63 – col. 5, line 20.

Therefore, it would have been obvious to one of ordinary skill in the art to modify Maenaka with Hamilton by implementing main diagonal and secondary diagonal directions for the chroma (red/blue) interpolation process for reducing artifacts at image output.

Regarding claim 8, Maenaka discloses that the interpolation of a blue pixel signal value at a green pixel location is based at least in part on computed B pixel value levels for red pixel locations adjacent the green pixel location and also on existing blue pixel locations adjacent the green pixel location in a mutually orthogonal direction (horizontal or vertical) to the adjacent red pixel locations in the subsampled color image (see col. 14, line 54 – col. 15, line 58 wherein a missing color component is calculated based on the other two adjacent color components and its existing adjacent color component).

Regarding claim 9, the claimed limitations are analyzed with respect to claim 7 wherein R hue is presented by G-R (Maenaka, col. 14, lines 14 – 18), and equations (2), (6) & (41) present color values of Blue plane (Maenaka, col. 14, line 54 – col. 15, line 58).

Regarding claim 10, the claimed limitations are analyzed with respect to claim 8 wherein red pixel signal value is calculated instead of blue pixel signal value.

5. Claims 13 – 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maenaka et al (US 5,552,827) in view of Yamashita (US 5,513,281).

Regarding claim 13, Maenaka discloses the limitations of claim 13, as analyzed in claim 1, by means of hardware system. Maenaka does not expressly teach software instructions which are stored in a memory to be executed for interpolating color pixel values from a subsampled image. However, as taught by Yamashita, it is obvious that interpolation process is either realized by means of hardware system or equivalent software procedures as suggested in col. 11, lines 31-34.

Therefore, it would have been obvious to one of ordinary skill in the art to implement the interpolation process by using either hardware system or equivalent software procedures stored in a memory such as ROM or removable memory.

Regarding claim 14, the claimed limitations are analyzed with respect to claim 3.

Regarding claim 15, the claimed limitations are analyzed with respect to claim 4.

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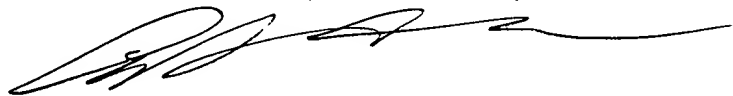
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nhan T. Tran whose telephone number is (703) 605-4246. The examiner can normally be reached on Monday - Thursday, 8:00am - 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew B Christensen can be reached on (703) 308-9644. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9314 for regular communications and (703) 872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

NT.
August 4, 2003



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